

REMARKS

Reconsideration of the application is requested in view of the amendments to the claims and the remarks presented herein.

The claims in the application are claims 1, 2 and 4 to 16, all other claims being cancelled.

Claims 1, 3 and 5 stand rejected under obviousness double patenting with respect to U.S. patent No. 5,993,736 and claims 6 and 7 were rejected over the same patent taken in view of a prior art admission. The Examiner deems the claimed Sn-Ag solder overlaps the claims of the patent. Claim 1 was rejected as being anticipated by the '736 patent and claims 3 and 5 were rejected under 35 U.S.C. 103 as being obvious thereon.

Claims 1 to 3 and 5 were rejected as being anticipated by EP 0612578 and claim 4 was rejected as being obvious thereover. Claims 6 and 7 were rejected as being obvious over the '578 or '736 patents taken in view of the prior art admission.

Applicants respectfully traverse these grounds of rejection since neither reference anticipates or renders obvious the presently amended claims. Claim 1 is directed to a tin-silver solder containing 0.3 to 1.0 % by weight of zinc and claim 2 is directed to said further containing indium which have enhanced joint strength in an initial stage and curtails a decrease in joint strength after heat treatment due to the presence of 0.3 to 1.0% by weight of zinc.

In contrast thereto, U.S. patent No. 5,993,736 concerns an invention which can obtain excellent tensile strength and a high elongation value by a Sn-Ag based lead-free solder alloy containing 2 to 4 wt.% of Ag, 0.5 to 2 wt. % of Zn, and 2 to 6 wt. % of Bi. EP 0612578 concerns an invention which enhances tensile strength and offset yield strength by a lead-free solder material containing 1.0 to 6.0 wt. % of Ag and 0.2 to 6.0 wt. % of Zn, the remainder being Sn.

That is, USP 5,993,736 claims a solder which is a four-element alloy necessarily containing Bi, whereas the new claim 1 of the present application recites a solder which is a three-element alloy containing no Bi. Thus, the solder of USP 5,993,736 and the solder of the present invention are completely different. Accordingly, claim 1 of the present application does not constitute double patenting with respect to USP 5,993,736.

Furthermore, USP 5,993,736 and EP 0612578 are intended to enhance tensile strength, while claim 1 of the present application aims at improving joint strength in the initial stage, and enhancing the effect of curtailing a decrease in the joint strength after heat treatment.

The tensile strength refers to the breakage strength of a solder itself when the solder is machined into a predetermined shape (see Referential Fig. 1 of the attachment) and pulled, as described in Experimental Example 1 of USP 5,993,736. The joint strength refers to peel strength working between plates 11a and a solder 12 when a pair of the copper plates 11a each having a Ni-10p plating layer 11b are joined together by the solder 12, and these plates 11a are pulled, as described in the specification of the present application and as shown in FIGS. 1(a), 1(b).

That is, USP 5,993,736 and EP 0612578 aim at improving the strength of the solder material itself and, for this purpose, contrive the types of the constituent metals and their proportions in the composition. On the other hand, claim 1 of the present application contrives the types of the constituent metals and their proportions in the composition to enhance the peel strength of materials joined together. This will be understood from Referential Fig 2 submitted herewith which shows the relationship between the amount of Zn added and the joint strength, which is a drawing prepared based on the data described in Tables 2 and 3 in the specification of the present application. As seen from this Referential Fig. 2, it is clear that a remarkable peel strength is obtained when the amount of Zn added is in the range of 0.3 to 1.0 wt. %.

As discussed above, the above-described properties which are obtained remarkably by the aforementioned proportions in claim 1 of the present application are unique which are neither described nor suggested in USP 5,993,736 and EP 0612578.

The above-mentioned characteristics in claim 1 of the present application remarkably giving the unique properties, which are neither described nor suggested in USP 5,993,736 and EP 0612578, cannot be obvious from USP 5,993,736 and EP 0612578.

With respect to claim 2, EP 0612578 enhances tensile strength and offset yield strength by a lead-free solder material containing 1.0 to 6.0 wt.% of Ag, 0.2 to 6.0 wt.% of Zn and 0.2 to 6.0 wt.% of In, the remainder being Sn. On the other hand, claim 2 of the present application can enhance joint strength in the initial stage, and markedly curtail a decrease in the joint strength after heat treatment, by incorporation 0.1 to 1.0 wt.% of Zn into a lead-free Sn-Ag based solder.


That is, EP 0612578, as explained above, aims at improving the strength of the solder material itself and, for this purpose, contrives the types of the constituent metals and their proportions in the composition. On the other hand, claim 2 of the present application, like claim 1 of the present application, contrives the types of the constituent metals and their proportions in the composition to enhance the peel strength of materials joined together.

The above-described properties which are obtained remarkably by the aforementioned proportions in claim 2 of the present application are unique which are neither described nor suggested in EP 0612578.

The above-mentioned characteristics in claim 2 of the present application remarkably giving the unique properties, which are neither described nor suggested in EP 0612578 and cannot be anticipated or rendered obvious from EP 0612578. Therefore, withdrawal of these grounds of rejection is requested.

In view of the amendments to the claims and the above remarks, it is believed that the claims point out Applicants' patentable contribution. Therefore, favorable reconsideration of the application is requested.

Respectfully submitted,
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